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Minimum standards of anorectal manometry

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INTRODUCTION

This document is based on the review of the pertinent literature, the relevance to clinical practice and the consensus opinion of the group.

Background

Functional disorders of the anus and rectum affect 10–20% of the population.[1] Tests of anorectal function can provide useful information regarding the pathophysiology of disorders that affect continence and defecation or those that cause anorectal pain.[2–5] Currently, several tests are available[2–6] for evaluating anorectal function (Table 1). Often, they complement each other,[2–4] but among the various tests that are available, the two most commonly performed tests are: (i) anorectal manometry and (ii) the balloon expulsion test. Recent studies suggest that manometric tests can be useful in the management of defecation disorders.[3,7] The diagnostic potential and yield of these tests have been described previously.[2,3,7] However, there is lack of uniformity with regard to the methods of performance and interpretation of the tests.[2,5,6,8–10] There is also a relative lack of normative data stratified for age and gender.[2,5,8] Individual laboratories are therefore encouraged to either consult published data or establish their own normative data.

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Purpose

To develop minimum standards for performing anorectal manometry. Towards this goal, this document will focus on: (i) a probe for testing anorectal manometry; (ii) describing a technique for performing manometry; (iii) defining the parameters for measuring and interpreting the tests; and (iv) developing a standard template for reporting the results.

Indications

1 Faecal incontinence
2 Constipation
3 To assess patients prior to and to facilitate biofeedback training of the evacuation and continence mechanisms
4 Miscellaneous
- Pre/post surgery (pouch, colonic reanastomosis)
- Functional anorectal pain

STUDY PREPARATION

Equipment

This consists of four essential components; a probe, a pressure recording device (amplifier/recorder, pneumohydraulic pump, pressure transducers), a device for displaying the recording (monitor, printer or chart recorder) and a data storage facility (computer, chart recorder).

Probe

Two types of probes are currently used: (i) a solid-state probe with strain gauge transducers; and (ii) a water-perfused probe.

Table 1 Tests for assessing anorectal disorders

Tests commonly performed
Anorectal manometry
Balloon expulsion test
Anal endosonography
Tests commonly performed and of uncertain clinical value
Defecography
Pudendal nerve terminal motor latency
Anal electromyography
Saline continence test
Tests performed in research laboratories
Rectal barostat testing-visceral sensation and tone
Anal vector manometry
Scintigraphic defecography
Ambulatory anorectal manometry

Configuration

A six-sensor, solid-state probe or a water-perfused probe with the following configuration is recommended. The solid-state transducers or the side holes will be arranged radially and spaced 1, 2, 3, 4, 5 and 8 cm from the 'O' reference point (Fig. 1). The diameter of the probe may not exceed 5–6 mm. At least a 4-cm long, compliant balloon (preferably nonlatex) will be tied on the probe. The side hole or the transducer at 8 cm will be located inside the balloon. A schematic diagram of the probe with the radial configuration and the location of sensors (from anal verge or 'O' reference point) is shown.

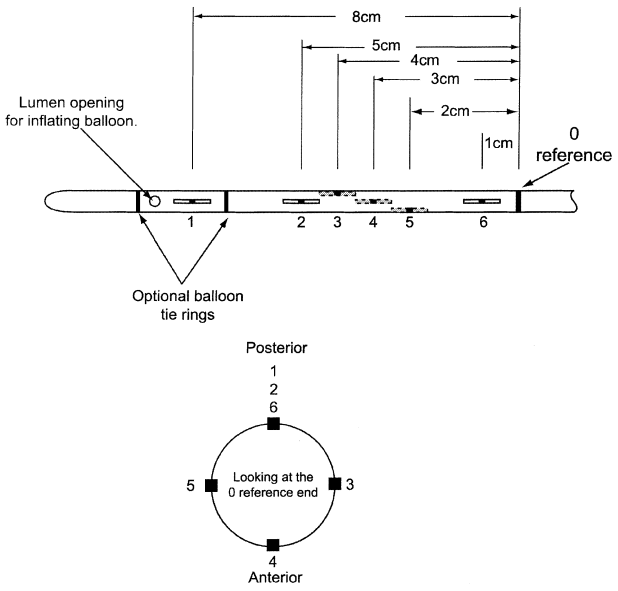

Figure 1 Proposed configuration of anorectal manometry probe. It shows the sensor locations, the radial array of anal sensors, the location and length of balloon and the intra-balloon pressure sensor.

Amplifier/recorder

With the advent of computerized systems, it is anticipated that most centres will use commercially available, small size amplifiers and recorders for performing gastrointestinal manometry (for example, Polygraph-Medronics/Functional Diagnostics, Minneapolis, MN, USA; Insight, Sandhill Scientific Ltd, Littleton, CA, USA; 7-MPR, Gaeltec, Isle of Skye, UK and others). It is anticipated that equipment that meets industry and safety standards will be purchased. A recorder with a recording frequency of at least 8 Hz is recommended.

Monitor For computerized systems, a monitor is recommended.

Software Several software programs are commercially available for displaying pressure recordings. At the present time, the current consensus opinion is that no one system is ideal, although each has its strengths and weakness. The group does not recommend any particular system, but anticipates that the user will purchase a program that is user-friendly and accomplishes the goals of performing manometry. Current software does not reliably interpret manometry.

Calibration

It is extremely important to calibrate the recorder and the probe accurately by following the manufacturers' instructions. The calibration should be saved and printed along with the recording in order to validate the measurements and to ensure accuracy of recording.

Water-perfused system When using the water-perfused manometry system, the pneumohydraulic pump should be started, the reservoir filled with water and a standardized rate of perfusion should be set. When using a perfusion system, a rate of 0.2 mL–0.4 mL min^{-1} with a pressure head of 10 psi (pounds per square inch) is recommended. The transducers located on the perfusion pump and the perfusion ports must be at the same level during calibration and when performing the study. After the probe is placed inside a patient, particular care should be taken to ensure that the probe and the transducers are at the same level. If not, the baseline should be reset.

Solid-state system Here, the calibration steps are much simpler and involve calibrating the transducers

to the atmospheric zero level (zero point or low calibration) and the maximum or 'high-point' calibration, usually 50 or 100 mmHg. The probe, the transducer and the recorders need not be placed at the same level during the test if solid-state transducers are being used.

STUDY PROTOCOL

Patient preparation

Bowel preparation is optional. Subjects will be asked to empty their bowels before the test. However, if the digital rectal examination reveals that the rectum is loaded with stool then a 500-mL tap water enema or a single Fleets® phospho-soda enema should be given. At least 30 min should elapse between evacuation of stool (from the enema) and probe placement. Patients may continue with their routine medications but the medications should be documented to facilitate interpretation of the data. Patients may eat or drink normally up to the time of the test. Upon arrival at the motility laboratory, the patient may be asked to change into a hospital gown.

Select appropriate test/manoeuvre

Because anorectal manometry consists of several manoeuvres, at the outset, it is important to determine whether a patient needs all of the manoeuvres or only a selection from the array of tests described below. The patient's symptoms and the reason for referral are helpful in choosing the appropriate list. A suggested list is given in Table 2.

Patient position

It is recommended that the patient is placed in the left lateral position with knees and hips bent to 90°.

Digital examination

After explaining the procedure, a digital rectal examination should be performed using a lubricated gloved finger. The presence of tenderness, stool or blood on the finger glove should be noted.

Probe placement

Next, the lubricated manometry probe is gently inserted into the rectum and orientated such that the most distal sensor (1 cm level) is located posteriorly at 1 cm from anal verge. The markings on the shaft of the probe should aid this orientation. If the patient reports any pain or discomfort during probe insertion, it should be pulled back or removed. Reinsertion may be attempted once more, but preferably the staff physician's assistance should be sought. Once the probe is correctly positioned, surgical tape may be applied to keep it in place.

Run-in time

After probe placement, a rest (run-in) period should be allowed (about 5 min) to give the subject time to relax and the sphincter tone to return to basal levels. If present, ultraslow wave activity may be noted. This consists of phasic pressure activity at 1–1.5 cycles min^{-1} with amplitude ≥ 40 mmHg.[11,12] Its significance is unknown, but when present may pose problems with interpreting anal resting pressure. It is more commonly seen in men and is associated with either normal or hypertonic anal sphincter.[11,12]

Squeeze

This manoeuvre assesses the anal sphincter pressure during volitional effort. Here, the subject is asked to

Table 2 Suggested list of tests/manoeuvres based on potential indication(s)

	Indication for test		
Test/manoeuvre	Incontinence	Constipation	Pre-op/pouch
Resting pressure	Yes	Yes	Yes
Squeeze pressure/duration	Yes	Optional	Yes
Cough reflex	Yes	No	Optional
Attempted defecation	No	Yes	Optional
Rectoanal inhibitory reflex	No	Yes	Yes
Rectal sensation	Yes	Yes	Yes
Rectal compliance	Optional	Optional	Optional
Simulated defecation or balloon expulsion	No	Yes	Optional

squeeze the anus for as long as possible, maximum 30 s, followed by 1-min rest. This manoeuvre is repeated once more.

Cough reflex test

This manoeuvre tests the reflex increase in anal sphincter pressure during abrupt change in intra-abdominal pressure, i.e. mimics a 'cough' response. The patient is either asked to cough or is given a balloon and asked to blow it up. The manoeuvre is repeated once more.

Attempted defecation

This manoeuvre examines the rectal and anal sphincter responses during attempted defecation and thereby assists in the evaluation of patients with dyssynergia.[13] Here the patient is asked to bear down as if to defecate (while lying on the bed). This test is repeated once more. A 30-s rest interval may be allowed between each attempt.

Rectoanal inhibitory reflex

This manoeuvre examines the integrity of the myenteric plexus between the rectum and anal canal. The reflex is typically absent in Hirschsprung's disease. The rectal balloon is rapidly distended with 50 mL air. The presence or absence of anal sphincter relaxation is noted. If there is no relaxation, a higher volume may be used up to a maximum volume of 250 mL.

Rectal sensation

This manoeuvre consists of intermittent balloon distension of the rectum and provides an assessment of rectal sensation, the rectoanal inhibitory reflex and rectal compliance. The rectal balloon is inflated with air at a rate of 10 mL per second. Initially, the balloon volume is increased in increments of 10 mL until the subject reports a first sensation. Thereafter, the balloon volume is increased by steps of 30 mL up to a maximum volume of 250 mL. The distentions should be terminated earlier if the maximum tolerable volume is reached. After each inflation, the distension is maintained for 30 s and then the balloon is completely deflated. After a rest period of 30 s, the balloon is re-inflated to the next volume.

During the test, the subject is provided with a sensory scale chart (see Table 3). If after infusing 250 mL of air, the subject does not report any discomfort or desire to defecate, further distentions may be aborted.

Simulated defecation

This test provides an assessment of defecation and should be performed if a subject shows a dyssynergic[13] or obstructive pattern of defecation (Fig. 2). This manoeuvre is in addition to balloon expulsion test and is indicated only if there is abnormal balloon expulsion (see below). The subject is asked to sit on a commode. The rectal balloon is inflated with 50 mL of water to provide a sensation of rectal fullness. The subject is then asked to bear down as if to defecate and expel the balloon. If there is no anal relaxation, the manoeuvre may be repeated once more. The probe is removed.

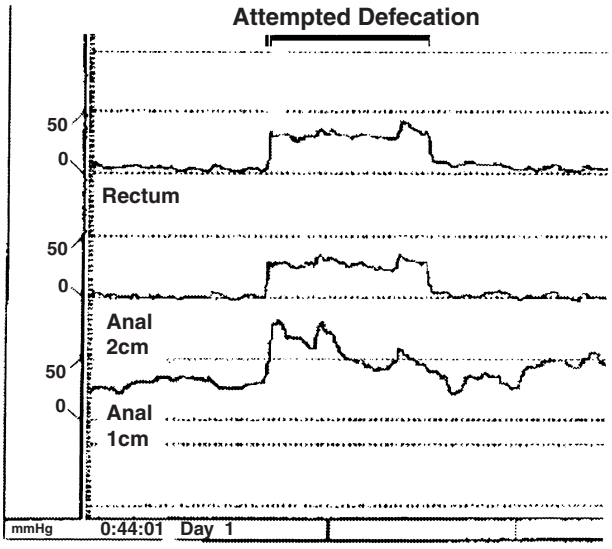

Figure 2 Rectal and anal pressure changes during attempted defecation in a constipated patient showing a dypsynergic pattern of defecation.

Table 3 Sensory scale chart: rectal sensation

First sensation	A transient sensation of fullness or bloating or gas; a vague sensation that disappears completely.
Desire to defecate (DD)	A desire to have a bowel movement that lasts > 15 s.
Maximum tolerable volume (MTV)	The maximum volume of distension that is tolerable with or without pain.

Balloon expulsion test

This test provides an assessment of an individual's ability to expel a simulated stool. A nonlatex balloon, 4–5 cm long is placed inside the rectum. Before insertion, it is preferable to wet the balloon with lukewarm water rather than applying lubricating gel. The balloon is filled with 50 mL of warm water. After placing the balloon, the subject is asked to sit on a commode. A stopwatch is started and the attendant leaves the room. The subject is asked to expel the device in privacy. After expelling the device, the subject is instructed to stop the clock. After 3 min, the attendant returns. If the subject is unable to expel the device, it is removed after emptying the water.

MEASUREMENTS AND DATA ANALYSIS

Resting sphincter pressure

This is defined as the difference between the intrarectal pressure and the maximum anal sphincter pressure at rest (Fig. 3). After probe placement, at each level, i.e. at 1-, 2- and 3-cm from the anal verge, the maximum sphincter pressure is measured by averaging a 1-min segment. The mean of the three highest values observed at any site in the anal canal is taken as the maximum resting pressure. The pressure value and the site at which this is observed (i.e. 1 cm, 2 cm, etc.) are both recorded. In some subjects, ultraslow waves may be seen and their presence should be documented.

Maximum squeeze pressure

This is defined as the difference between the intrarectal pressure and the highest pressure that is recorded at any level within the anal canal during the squeeze manoeuvre. By scanning the two attempts to squeeze, the mean of the highest pressures recorded at any site in the anal canal is used to calculate the maximum squeeze pressure (Fig. 3).

Duration of sustained squeeze

This is defined as the time interval, in seconds, during which the subject can maintain a squeeze pressure at or above 50% of the maximum squeeze pressure (Fig. 3).

Pressure changes during cough reflex test

For each manoeuvre, the difference between the baseline pressure and highest intrarectal pressure (rectal pressure), and the difference between the baseline and the highest intra-anal pressure (anal residual pressure) is measured. Of the two manoeuvres, the profile that shows the highest increase in these pressures will be selected (Fig. 3).

Rectoanal pressure changes during attempted defecation

This manoeuvre may provide an explanation for difficult defecation.

During attempted defecation, normally there is an increase in the intrarectal pressure and a decrease in the intra-anal pressure (Fig. 4). Alternatively, there may be a paradoxical increase (Fig. 2), or absent relaxation or incomplete relaxation of the anal sphincter pressure.[3,5,13] It must be appreciated that laboratory conditions may induce artifactual changes. By observing the attempts to defecate, it is possible

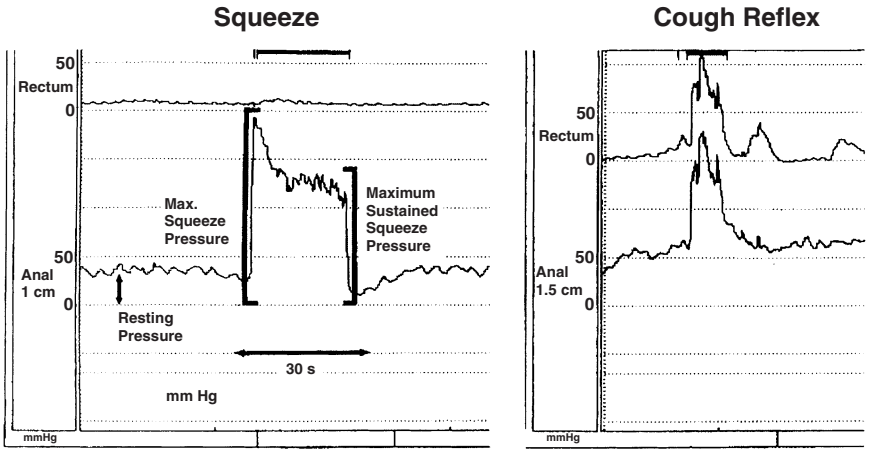

Figure 3 Normal squeeze and cough reflex test response. A method for calculating the rectal and anal pressure changes during these manoeuvres is also shown.

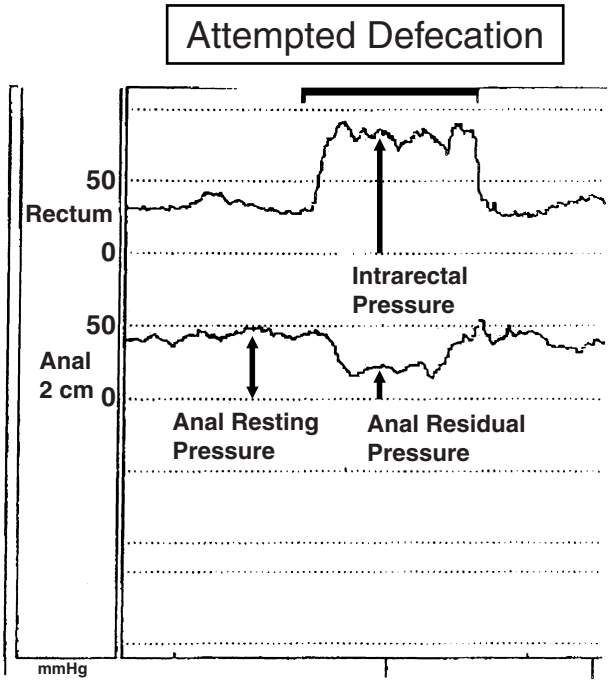

Figure 4 Normal rectal and anal pressure changes during normal defecation, also showing a method for calculating these pressure changes.

to identify the recording that most closely resembles a normal pattern of defecation (Fig. 4). This recording is then used to measure the intrarectal pressure, the residual anal pressure and the percentage anal relaxation. Residual anal pressure is defined as the difference between the baseline pressure and the lowest (residual) pressure within the anal canal, when the subject is bearing down. The percentage anal relaxation is calculated using the following formula:

$$\%\ \text{anal relaxation} = \text{anal relaxation pressure}/\text{anal resting pressure} \times 100$$

Rectoanal inhibitory reflex

The presence or absence of the rectoanal inhibitory reflex is noted. Often, this can be elicited at low volumes of distension (< 50 mL of air). This can also be assessed during intermittent rectal distension.

Rectal sensation

The lowest volume of air that evokes a first sensation and a desire to defecate is recorded. Also, the maximum tolerable volume is recorded.[1–10] The rectal sensory data should be interpreted along with the rectal compliance data.[14]

Rectal compliance

This is measured from the data obtained during intermittent rectal balloon distentions. Balloon distension of the rectum causes an initial increase in the intra balloon (rectal) pressure as air is introduced. This is followed by a slow decline in intra balloon pressure to a steady state value as the rectum accommodates to the increased volume. The steady state rectal pressure should be corrected by subtracting the pressure obtained during inflation of the balloon in ambient air. Rectal compliance is calculated by plotting the relationship between the balloon volume (dV) and the steady state intrarectal pressure (dP).[2,5,14]

$$\text{Compliance} = dV/dP = \text{mL mmHg}^{-1}$$

Simulated defecation test

The inability to expel the balloon or the time it took to expel the balloon is recorded. (Normal range = 10 s–3 min, median = 50 s.)[5]

STANDARD REPORT

General information

1 Patient identifier (name, date of birth, gender, hospital number, procedure number, institution)
2 Date and time of procedure
3 Referring physician or source
4 Indication(s) for test
5 Medication(s) and surgeries
6 Type and configuration of probe:
  (i) Solid state/water perfused, type of balloon used-its location and length.
  (ii) Number of sensors, orientation and location of sensors from anus.
7 Documentation of calibration

Anal sphincter pressures

1 Resting sphincter pressure (mmHg)
2 Squeeze sphincter pressure (mmHg)
3 Duration of sustained squeeze(s)
4 Cough reflex
  (i) Rectal pressure (mmHg)
  (ii) Anal pressure (mmHg)

5 Attempted defecation
(i) Rectal pressure (mmHg)
(ii) Anal pressure (mmHg)

Rectoanal inhibitory reflex

1 Present/absent

Rectal sensation

1 Threshold for first sensation (mL)
2 Threshold for desire to defecate (mL)
3 Maximum tolerable volume (mL)

Balloon expulsion test

1 Could expel/could not expel
2 Time taken for expulsion(s)

Comments/interpretation/summary

Diagnosis

Identifier/signature

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